Managing talent in knowledge-intensive settings

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Abstract

Purpose – This paper seeks to explore the processes and channels through which valuable knowledge from outside the firm reaches those employees who can exploit that knowledge for innovative purposes. It seeks to identify the specific talents exhibited by the key individuals involved in facilitating these important knowledge flows. It also aims to detail the interventions which management can adopt to harness knowledge flow talents.

Design/methodology/approach – The methodology used was a single case study of a medical devices R&D group, incorporating social network analysis and semi-structured interviews.

Findings – It was found that it is now rare for a single individual to possess all the talents necessary to effectively acquire and disseminate external knowledge. Owing to the prevalence of information and communication technologies, a small number of uniquely skilled individuals specialize in acquiring valuable external knowledge, while an altogether different set of individuals specialize in disseminating that knowledge internally.

Originality/value – There is a dearth of literature in the knowledge management field directed towards understanding how the unique talents of those employees who are integral components of knowledge networks can be harnessed. Building on concepts of talent management and the technological gatekeeper, the specific talents exhibited by these individuals are explored. Then some organizational level interventions are pointed up, which can facilitate knowledge-intensive organizations in fully exploiting their resources to maximize innovative capabilities.

Keywords Knowledge management, Social interaction, Organizations

Paper type Research paper

1. Introduction

In today's knowledge-based economy, successful companies are those that constantly acquire new knowledge and disseminate it throughout the organization, and quickly embody it in new technologies and products (Nonaka, 1994). Previous research has firmly established the significant role of social networks in facilitating these knowledge flows (Leonard-Barton and Sensiper, 1998; Davenport and Prusak, 2000; Birkinshaw and Sheehan, 2002; Cross and Parker, 2004), particularly in research and development (R&D) settings where the importance of optimal knowledge flows has long been stressed throughout the study of the innovation process (Allen, 1977; Katz and Tushman, 1981; Tushman and Scanlan, 1981; Macdonald and Williams, 1993; Assimakopoulos and Yan, 2006; Allen *et al.*, 2007; Doak and Assimakopoulos, 2007). While a number of prominent social networking theories – such as the two step flow of communication (Lazarsfeld *et al.*, 1948; Katz and Lazarsfeld, 1955), the diffusion of innovations (Rogers, 1962, 1995), the technological gatekeeper (Allen and Cohen, 1969; Allen, 1977), and the tipping point of social epidemics (Gladwell, 2000) – all point to the pivotal role which a small number of individuals play in the successful diffusion of information and knowledge, scant attention has been directed towards examining the specific talents and competencies exhibited by these

key individuals. Such a dearth of research is surprising, particularly so in the knowledge management movement, which has often been defined as a ''conscious strategy of getting the right knowledge to the right people at the right time and helping others put information into action in ways that strive to improve organizational performance'' (O'Dell and Jackson, 1998, p. 4). Understanding and harnessing the talents of those key knowledge networkers will enhance an organization's ability to get the right knowledge to the right people.

To address this research gap, this study turns to the human resources literature and the emerging field of ''talent management''. A key stream of literature in talent management advocates that certain key positions contribute more to the organization's sustainable competitive strategy, and that management can be proactive in developing a talent pool to fill these positions (Becker *et al.*, 2009; Boudreau and Ramstad, 2005; Boudreau and Ramstad, 2007; Guthridge *et al.*, 2008; Collings and Mellahi, 2009). This study applies the principles of talent management to a particular knowledge intensive setting – the R&D division of a medical devices company. The results of this research make a number of important contributions to both knowledge management theory and practice. Firstly, we provide empirical evidence which extends the technological gatekeeper theory. Secondly, we provide a framework for the identification of pivotal positions in knowledge intensive settings. Thirdly, we identify the characteristics of key employees in the knowledge flow network and then point to some organizational level interventions which can facilitate knowledge intensive organizations in fully exploiting their resources to maximize innovative capabilities.

The remainder of this article is structured as follows. Section 2 discusses the importance of external knowledge to the firm's innovation capabilities. Section 3 then considers the processes through which external knowledge is imported into the firm and specifically reviews Allen's technological gatekeeper theory. Attention is also given to the ''central connector'', ''boundary spanner'' and ''knowledge broker'' concepts as discussed more recently in the community of practice (CoP) literature. Section 4 reviews the emerging talent management literature and explains how its principles can be utilized to promote knowledge flows. Section 5 then describes the case study site and considers the data collection methods adopted. The findings of the social network analysis (SNA) and semi-structured interviews are presented in section 6, followed by a discussion of these findings in section 7.

2. The value of external knowledge

The knowledge movement has received much attention in recent years, particularly in the field of strategic management. The culmination of this field of enquiry has seen the emergence of a knowledge-based view of the firm. Proponents of this view argue that knowledge is the most strategically important of the firm's resources because it represents intangible assets, operational routines, and creative processes that are difficult to imitate (Drucker, 1988; Cohen and Levinthal, 1990; Nonaka, 1994; Grant, 1996a, 1996b; Argote and Ingram, 2000; Carlsson, 2003). The debate is ongoing as to whether knowledge is actually the firm's most important resource, but what is clear is that most companies in one way or another have embraced the notion that to operate effectively in today's economy, it is necessary to become a knowledge-based organization (Zack, 2003). Few firms can afford to remain completely self-sustaining and even extremely large organizations have to import knowledge from the external environment (Allen, 1977). For firms competing on knowledge and the ability to innovate and adapt, it is essential that they keep abreast of the latest scientific and technological developments (March and Simon, 1958; Allen, 1977; Cohen and Levinthal, 1990). Increasingly, this knowledge is dispersed outside the firm's boundaries and among other companies, customers, suppliers, universities, national labs, industry consortia, start-up firms and individual minds (Allen, 1977; Chesbrough, 2003).

A number of scholars have examined how the exploration for and acquisition of external knowledge impacts innovation performance. In their seminal study, Cohen and Levinthal (1990) argue that the ability to exploit external knowledge (i.e. absorptive capacity) is a critical component of innovation capabilities. Using cross-sectional survey data of the American manufacturing sector, they find that the benefit of internal R&D investment is not so

much the specific technologies that result, but rather the ability to provide the firm with the general background knowledge necessary to exploit rapidly evolving scientific and technological knowledge. A later study of the biotechnology industry by Powell *et al.*(1996) reiterates the importance of absorptive capacity. Using a longitudinal SNA, it was found when there is a regime of rapid technological development, sources of expertise are so broadly distributed that no single firm has all the internal capabilities necessary for success. Instead, the locus of innovation will be found in inter-organizational networks of learning and R&D alliances are the admission ticket to those networks. In a similar vein, Tripsas (1997) studied the evolution of three firms in the typesetting industry. Only one firm was able to survive the huge technological changes that swept through the industry in the second half of the 20th century. Tripsas attributes this to the firm's external scanning activities which kept it alert to new technologies which were beyond their own knowledge base but proved critical in keeping up with industry developments. More recently, Frishammar and Horte (2005) surveyed 206 medium-sized Swedish manufacturing firms and reported that scanning the technological sector of the external environment was positively associated with innovation performance. An examination of the UK manufacturing industry yielded similar results (Laursen and Salter, 2006) but also found a curvilinear relationship between external search for knowledge and innovation performance. Firms that search external knowledge sources widely and deeply, tend to be more innovative. However, these benefits are subject to decreasing returns and a tipping point exists. Innovation performance tends to decrease when firm's search too widely and deeply.

Taken together, these studies and others suggest that external sources of knowledge are important for a variety of innovation-related outcomes. Knowing this, business leaders would naturally be interested in understanding how external knowledge flows into and around the firm, and how these processes can be enhanced. In this effort, we revisit the highly influential technological gatekeeper theory. Through decades of innovation research, the role of the gatekeeper has proven to be a critical factor in understanding the performance of R&D organizations as gatekeepers have served as key nodes in the innovation process – acquiring, translating, and disseminating external knowledge throughout the firm.

3. The technological gatekeeper

Throughout the 1970s and 1980s, a rich stream of research examined the processes through which knowledge of the latest technological advances enters the R&D group. This particular stream was headed by MIT's Thomas Allen and his seminal book *Managing the Flow of Technology* (Allen, 1977) documents over a decade's worth of studies with some of the largest American R&D corporations. Allen discovered that knowledge of the latest scientific and technological developments entered the R&D group through a two-step process. Not every R&D professional was directly connected with external sources of knowledge. Instead, a small minority had rather extensive external contacts and served as sources of knowledge for their colleagues. These individuals were termed ''technological gatekeepers'' (Allen and Cohen, 1969; Allen, 1971; Allen, 1977; Tushman, 1977; Allen *et al.*, 1979; Katz and Tushman, 1981; Tushman and Scanlan, 1981; Macdonald and Williams, 1994) as they served as the ''gate'' through which knowledge of external technology flows into the R&D group. Essentially, a gatekeeper is an individual who acquires technological knowledge from the outside world (step 1) and disseminates this to his or her R&D colleagues (step 2). Yet, the gatekeeper does not simply release external knowledge on mass. The gatekeeper translates knowledge gained from journal papers and personal contacts into terms that are understandable and relevant to local R&D colleagues. The translation of external knowledge is needed due to the divergence in language, routines, and coding schemes which exist between the R&D group and the world outside (Tushman, 1977). Indeed, Allen (1977) even suggests that the gatekeeper's principle contribution comes by way of the translation that they can perform between the two systems. A more formal definition explains that technological gatekeepers are those key individual technologists who are strongly connected to both internal colleagues and external sources of knowledge, and who possess the ability to translate between the two systems (Allen and Cohen, 1969; Allen, 1977;

Tushman and Scanlan, 1981). The gatekeeper concept is consistent with other theories of social diffusion, such as diffusion of innovations (Rogers, 1962, 1995), the strength of weak ties (Granovetter, 1973), structural holes (Burt, 1992), and the tipping point of social epidemics (Gladwell, 2000), which all point towards the crucial role a small number of exceptional people play in spreading valuable information, trends, and ideas.

Gatekeepers make a significant contribution to the innovation process by virtue of their pivotal position in the knowledge flow network. Not only do they act as the firm's antennae tuned to a variety of external broadcasting sources, they also exploit their familiarity of the internal knowledge network to internalize emerging technologies. Allen and Cohen (1969, p. 16) noted when studying gatekeepers in the R&D division of a large aerospace firm that ''. . . if one were to sit down and attempt to design an optimal system for bringing in new technological information and disseminating it within the organization, it would be difficult to produce a better one than that which exists''. Indeed, subsequent studies have provided the empirical evidence to support this claim. Development focused R&D projects containing gatekeepers have been found to be significantly higher performing than those without (Tushman and Katz, 1980; Katz and Tushman, 1981). A conceptualization of the activities of the gatekeeper is provided in Figure 1. The diagram highlights the role of Mike, a technological gatekeeper. Mike is well connected to external sources of knowledge. These connections enable Mike to keep abreast of the latest technological developments in the industry and indeed, in related industries. Mike is also well connected internally. Through these connections, Mike maintains an awareness of where the internal expertise resides. When Mike comes across potentially useful knowledge from the outside, he directs this to the internal colleague, Alan, Jane, Joe, Tina, or Simon, that he knows is best placed to exploit that knowledge. Before doing so, he possesses the ability to translate the external knowledge into a form that will ensure its consumption. Through this process, external knowledge is continually imported into the R&D group, R&D professionals are kept abreast of the emerging technologies in their field, which in turn contributes to the R&D group continuously producing innovative outputs in the form of new technologies, products, and processes.

Having reviewed the concept, we argue that the gatekeeper theory provides a useful lens to examine pivotal positions in knowledge intensive settings. Support for this argument can be found in recent research which reports that high performers tend to occupy strategically important network positions in their organizations (Cross and Thomas, 2008). Nevertheless,

Figure 1 Illustrating the gatekeeper in action

External Knowledge Sources

Mike

Alan

Jane

Joe

Tina

Simon

R&D Group

Continuous Innovation
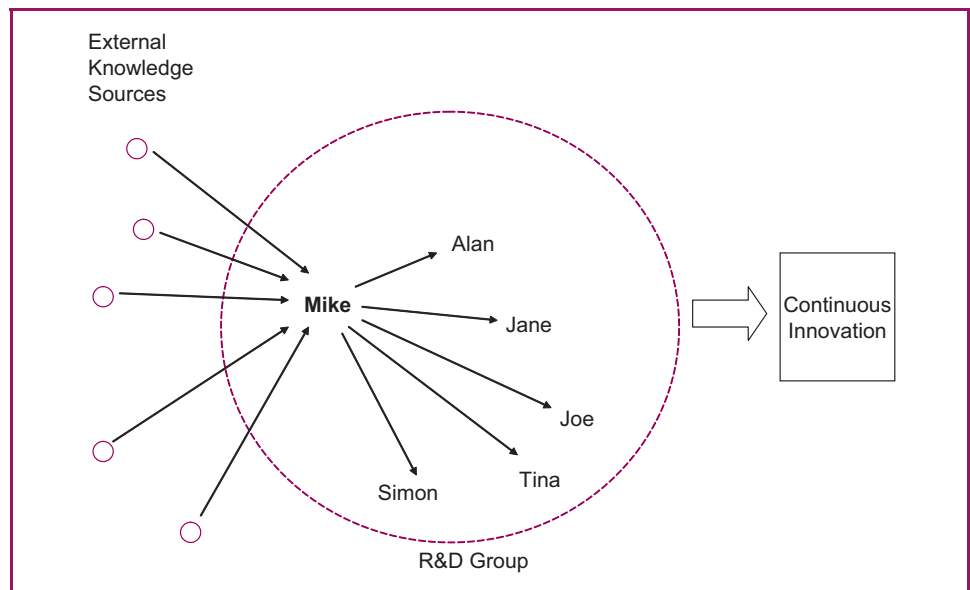
we acknowledge that the gatekeeper theory is a little outdated. It has been over 20 years since any significant investigation into the gatekeeper concept has been conducted. In more recent years, the the CoP literature has highlighted the related concepts of central connectors, boundary spanners, and knowledge brokers. However, little discussion exists as to how these concepts relate to or build upon the influential gatekeeper theory. We now turn our attention to this body of research in an effort to understand how it contributes to and extends the gatekeeper concept. These studies highlight the critical role played by a few key actors in facilitating CoP knowledge flows. Firstly, there are the central connectors – the ''go-to'' people who link their colleagues together (Cross and Prusak, 2002; Cross and Parker, 2004). These individuals are heavily connected and frequently sought out by their colleagues because they are seen as a valuable source of knowledge, for example, providing background information on clients or offering ideas on new technologies that can be employed in a given project (Cross and Prusak, 2002). Secondly, there are the boundary spanners. Boundary spanners are people who nurture connections with others outside the network and act as the group's eyes and ears in the wider world. They are often associated with innovation and entrepreneurship research because of their greater access to the external world, critical resources, and information (Dodgson, 1994). Thirdly, there are the knowledge brokers who are characterised by a wealth of indirect ties (Brown and Duguid, 2000). Knowledge brokers may be weakly linked to several internal communities at once (and full members of none); and they are strategically positioned to facilitate knowledge flow across communities (Pawlowski and Robey, 2004). Indeed, without these knowledge brokers, the network as a whole would not exist (Cross and Prusak, 2002). Knowledge brokers play a similar role to that of the boundary spanner, only they do it within the social network.

While the labels the CoP literature gives to these individuals are different, the role they perform is somewhat similar to that of the technological gatekeeper. Thus, the CoP literature only marginally extends the gatekeeper concept. It is explained that connectors, boundary spanners, and brokers are key to knowledge flows in work-related communities, yet limited consideration has been directed towards understanding the specific talents exhibited by these key actors. Additionally, the CoP literature seems to suggest that connectors, boundary spanners, and brokers are distinct individuals, but it is unclear whether a single individual could be both a connector and a boundary spanner. In contrast, the gatekeeper concept is clear in this regard and the role can only be performed by a single individual. For these reasons, we argue that the gatekeeper theory provides a more focused lens to examine pivotal positions in knowledge intensive settings. Yet, we also acknowledge that much has changed since the concept was first formulated. Not least of these changes have been the huge advances in information and communication technologies. The gatekeeper existed in a time when it was a difficult and time consuming process for the average R&D professional to acquire knowledge from beyond the company's boundaries. Thus, the gatekeeper mediated with the outside world on their behalf. What technologies such as the world wide web have changed is the ease and speed with which employees at all organizational levels can access and disseminate knowledge (Teigland and Wasko, 2003). As a result, recent studies suggest that the modern gatekeeper may have morphed into another role providing an altogether different range of services (Assimakopoulos and Yan, 2006; Whelan and Donnellan, 2008; Whelan et al., 2009). While we have a good understanding of the role and characteristics of those filling the traditional gatekeeper position, our conceptualization of the modern gatekeeper is limited. We argue that an understanding of the skills and competencies of those now occupying the gatekeeping position will provide valuable insights for KM managers, enabling them to take proactive steps to ensure that the right knowledge reaches the right people. To gain such an understanding, this article now turns to the emerging field of talent management.

4. What is talent management and why does it matter?

Talent management first came to the attention of practitioners and academics alike when a group of McKinsey consultants coined the phrase ''The War for Talent'' in the late 1990s

(McKinsey, 1998). In recent years, the term talent management has become well established in the managerial lexicon and now occupies a significant amount of organizational resources. Chief Executive Officers are increasingly involved in the talent management process, with the majority of those surveyed in a recent study spending over 20 per cent of their time on talent issues, with some even spending up to 50 per cent of their time on the same (The Economist Intelligence Unit, 2006). Notwithstanding this, a more recent study of 1,300 executives worldwide, argued that that senior managers do not spend enough time on talent management (Guthridge et al., 2008). Indeed, a Boston Consulting Group report identified talent management as one of five critical challenges for the human resource function in the European context (Boston Consulting Group, 2007). This growth in prominence of talent management can be attributed to the growing realization that the firm's human resources provide a key source of sustainable competitive advantage (Lowe et al., 2002; Caligiuri et al., 2005). However, as advocated by the resource based theory, possessing resources is insufficient to create competitive advantage. Firms must be appropriately organized to fully exploit their resources to attain a competitive advantage (Barney, 1997). To this end, talent management plays a key role in assisting the organization to ensure its human resources are utilized to the fullest extent.

Despite the widespread use of the terminology and its perceived importance, there is a degree of debate, and indeed confusion around the conceptual and intellectual boundaries of talent management. Broadly speaking there are four key streams of thought on what talent management is (Lewis and Heckman, 2006). In the first stream, some authors merely substitute the label talent management for HR management. Studies in this tradition often limit their focus to particular HR practices such as recruitment, leadership development, succession planning and the like. A second strand of authors emphasizes the development of talent pools focusing on ''projecting employee/staffing needs and managing the progression of employees through positions'' (Lewis and Heckman, 2006, p. 140). The third stream focuses on the management of talented people. Finally, there is an emerging body of literature which emphasizes the identification of key positions which have the potential to differentially impact the competitive advantage of the firm (Boudreau and Ramstad, 2005; Becker et al., 2009).

We adopt Collings and Mellahi's (2009) definition of talent management. They argue that talent management is concerned with three specific stages:

1. Activities and processes that involve the systematic identification of key positions which differentially contribute to the organization's sustainable competitive advantage.

2. The development of a talent pool of high potential and high performing incumbents to fill these roles.

3. The development of a differentiated human resource architecture to facilitate filling these positions with competent incumbents and to ensure their continued commitment to the organization. The emphasis of the current paper is on the first two aspects of this definition.

Collings and Mellahi argue that the first step in any talent management system should be the identification of the pivotal talent positions which have the greatest potential to impact on the organization's overall strategic intent. This is premised on the idea that, while every employee and every job contributes to the organization in different ways, it is ultimately only a small number of pivotal positions which have the potential to provide above-average impact on performance (Boudreau and Ramstad, 2007).

When this definition is adopted, the parallels between the fields of talent management and KM become evident. Since the 1980s, the focus of KM initiatives has shifted from a strategy of capturing data and explicit information in portals and databases to a strategy of promoting tacit knowledge sharing among people through informal social networks (Davenport and Prusak, 2000; Wenger et al., 2002, Parise, 2007; Whelan et al., 2009). As discussed in the previous section, KM scholars have come to learn that a small number of key employees have the power to drive the flow of valuable knowledge throughout social

networks, and that KM initiatives now need to focus on facilitating this key talent (Parise, 2007; Cross and Thomas, 2008). Indeed, Vaiman and Vance (2008) argue that that the fusion of talent management and KM holds important competitive implications for modern organizations as the successful generation, transfer, and exploitation of knowledge is heavily dependent upon the effective management of human talent. Specifically, it takes the support of a congruent set of people management practices to transform knowledge and know-how and to ensure it is utilized to the fullest extent to achieve organizational objectives (Lengnick-Hall and Andrade, 2008). However a key challenge in this regard is the fact that KM has traditionally been managed by the IT function, while talent management has been the domain of the human resource function (Legnick-Hall and Andrade, 2008; Vaiman and Vance, 2008). Hence there has often been a disconnect between the two areas. In line with some more recent contributions, this paper contributes to this emerging literature on the linkages between these two key areas of management practice.

Underpinned by Allen's technological gatekeeper theory, we argue that in knowledge intensive settings, the pivotal positions are those that facilitate the flow of external knowledge into the firm ensuring that it reaches the right people who can exploit that knowledge for innovative purposes. Once the pivotal positions are identified, the strategic talent management system advocates the development of a talent pool of high potential and high performing incumbents to fill these roles (Collings and Mellahi, 2009). In order to groom potential incumbents, management needs to know the specific talents of those occupying key positions in the knowledge flow network. This study seeks to address this need by identifying the specific competencies required by those R&D professionals who occupy the pivotal gatekeeper position.

5. Research methods

Utilizing a case study approach, we studied the R&D group of MediA[1], a medical device manufacturing firm operating in Ireland. The company is Irish owned, employs approximately 400 people, and has an annual turnover of approximately €37 million. The R&D group, referred to in the rest of the article as Group A, consisted of 42 engineers who specialized in the design and development of catheter-based minimally invasive devices. In minimally-invasive procedures, devices are usually inserted into the body through natural openings or small incisions and can be guided to most areas of the anatomy to diagnose and treat a wide range of medical problems. Knowledge from the external environment is of critical importance to Group A. Much of the work the group performs requires that they keep abreast of the latest advances not only in the medical device industry but also the polymer, metal, molding, and extrusion industries. Indeed, some of the group's best product ideas have come from scanning how other industries are using materials like disposable plastics.

Case study methods incorporating both quantitative (SNA) and qualitative (semi-structured interviews) procedures are deemed appropriate for this study as the objective is to obtain a rich, detailed insight into the ''life'' of that case and its complex relationships and processes (Eisenhardt 1989; Oates 2006). Such a multi-method approach extends previous gatekeeper studies as they have almost exclusively relied on quantitative data gathering approaches. Quantitative approaches offer testability and generalizability at the expense of deep and rich insights. Indeed, Laursen and Salter (2006) note deficiencies with quantitative approaches and call for more in-depth case studies to examine how firms organize their external knowledge search processes.

Given the relative infancy of research on talent management, our methods are broadly consistent with the qualitative focus of much of the extant research in the area. However, the inclusion of SNA is particularly innovative and is consistent with some emerging theoretical insights on the linkages between talent management and knowledge management (Jones, 2008; Parise, 2007).

Data were gathered from Group A during the months of October/November 2007 and consisted of two phases. Table I summarizes the data collection process. Phase 1 used SNA techniques to map the flow of knowledge into and around Group A. SNA is an established

Table I The data collection methods	
Methods	*Group A*
Phase 1 – Social network analysis	Online survey issued to all 42 group members, 38 returned completed (90 percent response rate)
Phase 2 – Semi-structured interviews	Ten recorded and transcribed, consisting of two gatekeepers, two externals stars, three internal stars, three non-stars

social science approach of studying human relations and social structures by ''disclosing the affinities, attractions and repulsions between people and objects'' (Moreno, 1937, p. 209). SNA views social relationships as nodes and ties which can be illustrated visually and mathematically. As such, it can provide an x-ray into the inner workings of a particular network. With this tool, important patterns become visible, the relationships between people can be better understood, the health of a group can be assessed and, the people playing key roles within the group can be identified (Cross and Parker, 2004). The specific purpose of using SNA techniques in this study relates to the last point – to identify the people occupying key knowledge flow positions within the group i.e. those performing the gatekeeper role. To collect these data, all group members were asked to complete a short online questionnaire on their internal and external communications. A copy of the questionnaire is provided in the Appendix, Figure A1. We adopt the classic definition of a gatekeeper as an individual who is both an internal communication star (i.e. in the top 20 percent of internal communication measures) and an external communication star (i.e. in the top 20 percent of external communication measures). While it can be argued that this is an arbitrary measure, it serves our purpose of identifying the key positions in the knowledge flow network. The SNA software package UCINET (Borgatti *et al.*, 2002) was used to illustrate Group A's knowledge flow network.

In phase 2, ten interviews with selected group members were conducted. The purpose of conducting interviews was twofold:

1. to validate that the patterns resulting from the initial SNA reflect reality; and

2. following the principles of talent management, the objective of the interviews was to explore the skills and competencies of those individuals performing the gatekeeper role.

The semi-structured interview format was deemed to be most appropriate for this purpose. The interviewees were selected based on the SNA results from phase 1. We interviewed two gatekeepers, two external communication stars, three internal communication stars, and three non-stars. Care was also taken to ensure that all levels of the formal group hierarchy were represented in the interviewee sample. All interviews were conducted face-to-face and ranged in length from 30 minutes to 75 minutes. In addition, all interviewees gave permission for the interview to be recorded. The procedures outlined in the dramaturgical model (Myers and Newman, 2007) were adopted in order to ensure that high-quality interviews were conducted. Interview data analysis was performed using the NVivo software package and followed established inductive qualitative methods: coding, data categorization, and pattern identification (Miles and Huberman, 1984; Eisenhardt, 1989; Yin, 1994).

6. The findings

6.1 Identifying pivotal positions through social network analysis

Figure 2 presents the SNA of Group A. The nodes in the diagram are the individual members of Group A and the lines represent the flow of technical knowledge between them. The more connected nodes tend to gravitate towards the centre of the network while those nodes with fewer connections tend to be found on the periphery. Gatekeepers are represented as diamonds and internal stars as downward triangles. The external stars are represented as triangles. The size of the triangle is reflective of how well connected that individual is to

Figure 2 A social network analysis of Group A
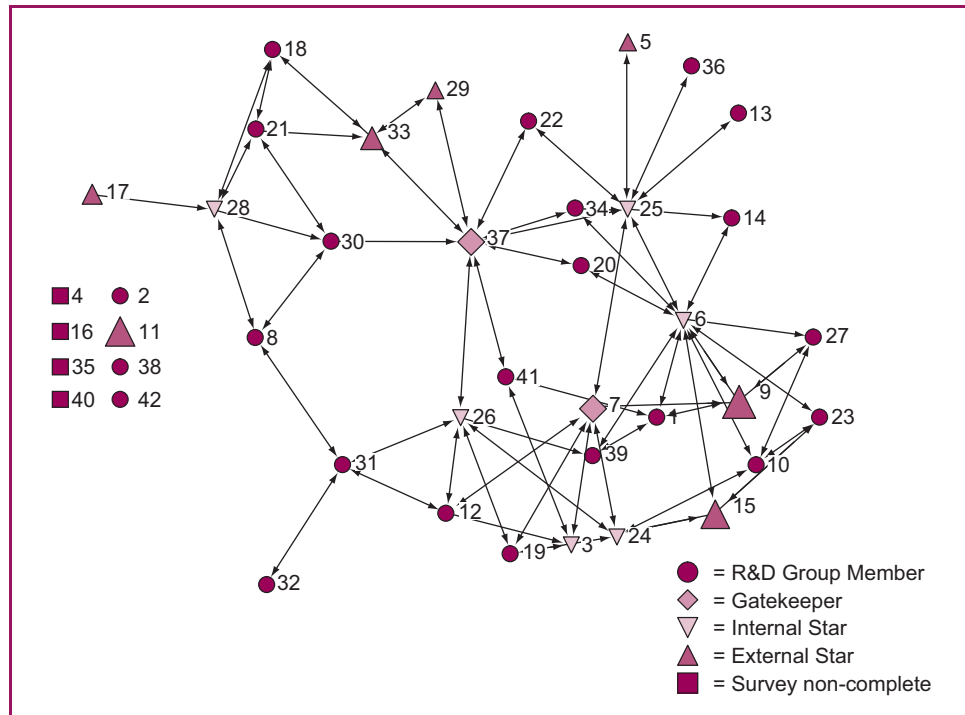
external knowledge sources. For example, node's 9 and 11 are the biggest triangles as these individuals are the most frequent users of external knowledge sources. 38 of the 42 group members completed the questionnaire, giving a response rate of 90 percent. Nodes 4, 16, 35 and 40 did not complete the questionnaire hence the reason they are isolated on the left. Nodes 2, 11, 38 and 42 are also isolates because they have no reciprocated interactions with another group member.

Figure 2 reveals a number of key people in Group A's knowledge flow network. Firstly, there are nodes 7 and 37. Using the classic definition, only these two members of Group A can be classified as technological gatekeepers. While external knowledge is imported and disseminated around the group by these two gatekeepers, the SNA evidence indicates that separate communication specialists also combine to perform the gatekeeping role. This suggests that the gatekeeper position has undergone a division of labor. One set of boundary spanning individuals acquire external knowledge, and a largely different set of individuals distribute this knowledge around the group. The relationship between node 5 and node 25 can be used to demonstrate this process (the relationship between nodes 17 and 28, nodes 9 and 6, or nodes 15 and 6 could also have been used). Node 5 is an external communication star. This individual is well connected to external knowledge sources but is not very well connected internally. Node 5 acquires external knowledge and communicates this to node 25. Node 25, on the other hand, is well connected internally and can distribute this knowledge around the group through his or her many connections. Semi-structured interviews were subsequently conducted to ascertain the key talents exhibited these individuals now performing the gatekeeper role.

6.2 Ascertaining the key talents of the pivotal actors

We interpreted the SNA evidence from Group A to purport that the gatekeeping role is performed either by single individuals – the gatekeepers themselves – or by a combination of external and internal communication specialists. We now present the interview findings using these terms as headings – starting with the external communication stars. The key

findings emanating from our interviews with the external stars, internal stars, and gatekeepers, are summarized in Table II.

6.2.1 External communication stars. Keeping abreast of the latest technological developments in the field is vital to the success of Group A. With the advances in information and communication technologies, all R&D professionals could easily acquire this outside knowledge. However, the SNA evidence indicates that external communications are monopolized by a small number of individuals. The interview evidence finds support for this statement. Knowledge of the latest technological developments are imported into Group A largely by those individuals identified as externals communication stars in the SNA. So what talents do these individuals exhibit? No particular individual or group of individuals are formally appointed to a technology scouting role. The process occurs more organically and is driven by the external communication stars. The following quote is representative of the views of most of the external stars interviewed. Reflecting on how Group A maintains awareness of industry developments, one external star offered his opinions and explained that some people just have a genuine interest in keeping abreast of the latest industry developments, while others:

> . . . could walk into a room wallpapered with valuable information about the most cutting-edge technologies in our field . . . but if they are not interested, then they won't even notice.

An early proposition formulated by the authors suggested that external communication stars were more likely to be recent university graduates, as the people in this age category would be more adapt at using the emerging web technologies like blogs, wikis, and social networking sites to keep abreast of the emerging industry trends. However, this proposition was not supported by our data. While the web is the primary channel through which external stars stay current with the most recent technological developments, external stars tend to be quite experienced. They also have the ability to understand exactly what external knowledge is relevant to the group. Having this ability only comes with a few years industry experience. One project leader in Group A explained the difference between these external stars and those younger engineers:

> I think possibly it's because they've just seen a bit more. When they find information on the Web, they know the level it needs to be at in order to make it useful, whereas a younger guy would come

Table II Summary table of those performing the gatekeeping role			
	Key skills	*Motivation/attitudes*	*Preferred media*
External communication stars	Ability to acquire relevant knowledge of external developments Narrow and deep technology domain knowledge Strong analytical skills	Genuine interest in keeping abreast of emerging trends in their speciality Primarily acquire knowledge for own use but lack the skills to disseminate effectively	Predominant web-based, e.g. Google search, online communities, materials websites
Internal communication stars	Ability to translate complex external knowledge into a form understandable by and relevant to internal colleagues Wider knowledge base which facilitates understanding the context of new knowledge and how it fits with extant knowledge	Enjoy helping others Develop their own knowledge from these interactions Expect reciprocation	E-mail and oral
Gatekeepers	Display both depth of knowledge of external communication star and breadth of knowledge of internal communication star Highly sociable with very good networking skills enabling them to develop extensive internal and external networks	May acquire knowledge for their own use but also transmit it to others Enjoy helping others	External – both web-based and oral Internal – e-mail and oral

back and say ''so I found all this stuff'' and you end up telling them that most of that is rubbish. The more experienced guys know exactly what we need from the outside world.

Additionally, the external communication stars tend to possess a deep, as opposed to a wide ranging knowledge of a specific technology domain. Many of the external stars interviewed had acquired PhDs. Having a deep and narrow knowledge domain would seem to be an important antecedent to being an effective external communication star. With so much information freely available through the web, an individual cannot decipher the truly novel technological developments from the rest unless they have considerable expertise in that particular domain. As one external star explained:

> I think the Web is the most direct and open way to finding new things. I suppose the idea of finding a new concept that's out there – you can't really go looking for something new and unknown if you have no reference for it. That's particularly true in my area – biomedical cements. Unless you know the field inside out, you are not going to know what the new developments are.

6.2.2 Internal communication stars. The external stars interviewed explained that they primarily acquire external knowledge for their own use, but if they come across information that would be useful to others, they would try to distribute it. However, external communication stars are not effective disseminators of knowledge as they seem to be lacking the necessary skills. To be useful to Group A, the knowledge acquired from outside sources needs to be translated into a form that is understandable and relevant to group members. This is a specific skill that is most likely to be found in the Group A's internal communication stars, hence it is these individuals that tend to disseminate the knowledge acquired by the external stars around the group. The interviews revealed that e-mail is the primary system used to alert colleagues to new knowledge from outside the company. This knowledge source is usually in the form of a web link or an attached document. While many e-mails are disseminated around the group containing information on current industry developments, many interviewees pointed out that only a fraction of these are given any attention. Two factors determine whether the content contained in an e-mail will actually be read and used further:

1. how the information in the e-mail is presented, i.e. translated so that it is relevant and understandable to the receiver; and

2. the sender of the e-mail.

Regarding the sender of information, certain members of the both group's have a reputation for blasting out non-relevant content to the rest of their colleagues. One of Group A's internal communication stars refers to these individuals as ''e-mail jockeys'' and explained that:

> . . . rather than taking ten minutes out to walk over and discuss that new information with someone, these guys constantly FYI e-mails around to everyone. That's not really transferring knowledge. These e-mail jockeys are useless . . . nobody ever reads the e-mails they send around anyway.

Unlike the ''e-mail jockeys'', the internal stars are aware that an e-mail containing novel knowledge will only be read if it is translated into a form that is relevant and understandable to the recipient. Rather than blasting out an e-mail under the title FYI, they tend to include a short introduction on the e-mail that explains/translates why the knowledge contained is relevant to the receiver. It seems that the internal communication stars possess these translation skills and their e-mails gain the attentions of the intended recipients as a result. In contrast, the ''e-mail jockeys'' do not translate the knowledge contained in their e-mail messages, possibly because they do not have technical competence to perform the translation, and their messages are rarely read as a result.

The internal stars possess differing abilities to the external stars and these abilities enabled them to excel in the dissemination of external knowledge. Rather than possessing the deep technical expertise or the analytical skills of the external star, the internal star possesses a strong breadth of technical knowledge. While the internal star has a strong knowledge of their own specific technology domain, they have also acquired a good knowledge of other technologies relevant to the R&D group. When they become aware of an emerging technology, they have the technical competence to have a discussion with a colleague

regarding how that knowledge can be exploited by the R&D group, even when that technology is not their specialty domain. Internal stars also need to possess a good understanding of what expertise group members have so that they can direct relevant knowledge specifically to those individuals. The internal stars explained that they gain this familiarity through their networking talents. They have a reputation among their peers for being approachable and are frequently sought out for consultation. Through these interactions, they learn of other's expertise and build their network of contacts in this manner. As one internal star explained: ''I think I'm approachable . . . I love talking to people, I don't mind people coming to me with anything.'' Another explained that it is his deliberate strategy to develop a personal network which stretches to all parts of R&D. In his own words, he views his network of contacts as a ''two way street.'' Having an extensive network enables him to distribute knowledge to the most relevant individuals while also receiving knowledge in return.

6.2.3 Gatekeepers. Using the classic definition, only two members of Group A could be classified as technological gatekeepers. The evidence emerging suggested that it is possible but rare for a single individual to possess both the depth of knowledge needed to be an external communication star, and the breadth of knowledge needed to be an internal communication star. Our interviews with the gatekeepers focused on understanding how their competencies differed from that of the external and internal communication stars. Regarding internal communications, we found little difference between the competenicies of the gatekeepers and the internal stars. Both are very approachable, use a combination of e-mail and oral conversations to disseminate knowledge, and have excellent social networking skills. The difference lies in their contrasting abilities to acquire external knowledge. Gatekeepers have the ability to extend their network of contacts beyond the organization's boundaries. However, in terms of external communications, gatekeepers differ significantly to external stars. While the external stars tended to use the web to keep abreast of external developments, gatekeepers preferred to use oral communications. The gatekeepers have many contacts outside the company and they phone these on a regular basis. Certain social skills are needed to develop this network of contacts and to extract knowledge from them. These social skills do not come naturally to most R&D professionals and this maybe is one reason why the web is the preferred source of external knowledge for others. Such high social skills are not needed to extract information from the web. An example of the social skills needed to extract knowledge from others is provided in the following interview excerpt with one gatekeeper:

> The guys in the tool workshop are a great source of ideas for me . . . but if you need to know something, it's no good sending these guys an e-mail. They will only help you out if they think you are a peer. There's no point going down to these guys wearing a three-piece suit . . . if the tool guys don't see you as a peer or with a bit of dirt on you then the answer you will get from them will be different and probably not as helpful. I would say that most people in [Group A] are weary about going down to the tool workshop. You just have to know how to deal with them.

7. Discussion and conclusions

While this study finds that the gatekeeping tasks of acquiring, translating, and disseminating external knowledge are integral to the R&D operation, we also find that these tasks no longer need to be performed by a single individual. Instead, the findings from the SNA and the interviews show that the gatekeeper role has undergone a division of labor. While gatekeepers were found to exist, they were rare. It is more likely that the gatekeeping role will be performed by external and internal communication specialists who combine their unique talents together. A key contribution of this study is the identification of the competencies evident in both external and internal communication stars, and the gatekeepers themselves. This will provide knowledge intensive organizations with the information required to identify these competencies in the individuals within their talent pools, and to deploy these individuals in positions which will maximize their contribution to the firm's innovative capabilities. Underpinned by the principles of talent management, we argue that disproportionate resources should be

allocated to the small number of positions which make the biggest difference to strategic success. In knowledge intensive settings, the gatekeeper represents such a pivotal position. Previous studies have firmly established the gatekeeper to be a pivotal position when optimal knowledge flows are required for innovation (Allen and Cohen, 1969; Allen, 1977; Tushman, 1977; Tushman and Katz, 1980; Katz and Tushman, 1981; Katz and Tushman, 1983; Macdonald and Williams, 1993). For firms competing on innovation, the gatekeeper is a pivotal position which needs to be filled with talented incumbents. Our study extends the gatekeeper theory and shows that the role is more likely to be performed by separate external and internal communication specialists. This finding bears many similarities to the CoP literature which distinguishes between boundary spanners and central connectors. We now combine our findings with this literature in an effort to understand how KM managers can systematically nurture the handful of talented employees who drive the flow of knowledge in organizational networks.

Managers of knowledge intensive settings would be interested to know what they can do to identify and facilitate the external and internal communication star positions. The SNA procedures presented in the research methods section of this article will enable managers to identify the individuals occupying these key positions. We now point to some interventions which can be undertaken to facilitate and enhance the important contribution of these atypical individuals. Firstly we consider the external communication star position. Those who possess numerous years industry experience and maintain a deep expertise in a particular field (as evidenced by a PhD qualification) are best suited to the external star position. This is due to the vast array of knowledge sources made easily accessible with the prevalence of web based technologies. It is only with a deep knowledge of a specific field that a knowledge worker can distill the valuable knowledge sources from the rest. Interestingly, this finding is in sharp contrast with the CoP literature which suggests that boundary spanners are a rare breed because few people possess the breadth of expertise needed to perform this role (Cross and Prusak, 2002). To maximize their contribution to the knowledge flow network, external stars should be freed any mundane administrative duties and allocated the time they need to scan the external environment for emerging technologies and trends. In terms of resources, all they need is a PC with an internet connection. Management can also facilitate the external star by ensuring that they are making the right external connections. For example, it would more beneficial if external stars are given priority for external networking events such as conferences or tradeshows.

Second, we consider the internal communication star position. External stars specialize in acquiring valuable external knowledge. This is a time consuming and complex process which inhibits their ability to distribute that knowledge around the internal communication network themselves. This is the domain of a different set of individuals, the internal communication stars. The internal star described in this study and the central connector described in the CoP literature are quite similar concepts. Internal stars have a natural flair for getting to know others. Rather than possessing a deep knowledge of a specialist field, these individuals are good all-rounders. If management fails to recognize the valuable role performed by these individuals, there is a danger that their knowledge dissemination efforts could be stifled. Internal stars need the opportunity to network. Involving these individuals in multiple projects throughout the firm will enable them to build their network more rapidly, allowing them to become more effective disseminators of knowledge. Cross and Parker (2004) also advise organizations to change aspects of their performance management systems to regularly reward internal stars and central connectors. These authors cite the example of an investment bank who rated each manager's ability to link people in the bank together. The most successful connectors (those who improved the flow of internal knowledge) were awarded bigger bonuses. Specific attention should be given to establishing connections between the external stars and the internal stars of a particular grouping. This study finds that it is primarily through these particular connections that valuable external knowledge becomes integrated into the firm. An additional reason why KM managers

should systematically cultivate the internal star position relates to the important topic of knowledge translation. The KM movement has recognized that the successful transfer of knowledge from point A to point B is heavily dependent on translation processes (Argote and Ingram, 2000). As knowledge becomes more specialized, it develops its own terminologies, which inhibits the accessibility of that knowledge to others (Tushman, 1977). Translation involves converting specialized knowledge into a form that is understandable and relevant to others. Our case study reveals that internal stars are frequently sought out by their colleagues because they possess the breadth of expertise necessary to translate external knowledge.

Finally, at an organizational level it is important for organizations to facilitate interaction and collaboration between information technology and human resource professionals to maximise the potential for talent management systems to embrace the opportunities provided for knowledge sharing within R&D teams.

We see two additional areas for future research. Firstly, while our findings make an important contribution to the management of talent in knowledge intensive settings, they are based on only a single case study with a medical devices R&D group. For the purposes of generalizability, future research studies should examine multiple knowledge intensive groupings in differing industries. Secondly, our findings show that the gatekeeping role can be performed by a single individual or by a combination of internal and external communication specialists. Previous research has found a positive relationship between the existence of the gatekeeper and innovation performance. Our findings here show that the gatekeeper role has undergone a division of labor and is now performed by separate communication specialists. Future research needs to empirically examine the relationship between innovation performance and the knowledge diffusion activities of these individuals.

Note

1. Company name is fictitious to preserve anonymity.

References

Allen, J., James, A.D. and Gamlen, P. (2007), ''Formal versus informal knowledge networks in R&D: a case study using social network analysis'', *R&D Management*, Vol. 37 No. 3, pp. 179-96.

Allen, T.J. (1971), ''Communication networks in R&D laboratories'', *R&D Management*, Vol. 1, pp. 14-21.

Allen, T.J. (1977), *Managing the Flow of Technology*, MIT Press, Cambridge, MA.

Allen, T.J. and Cohen, S.I. (1969), ''Information flow in research and development laboratories'', *Administrative Science Quarterly*, Vol. 14 No. 1, pp. 12-19.

Allen, T.J., Tushman, M.L. and Lee, D.M.S. (1979), ''Technology transfer as a function of position in the spectrum from research through development to technical services'', *Academy of Management Journal*, Vol. 22 No. 4, pp. 694-708.

Argote, L. and Ingram, P. (2000), ''Knowledge transfer: a basis for competitive advantage in firms'', *Organization Behaviour and Human Processes*, Vol. 82 No. 1, pp. 150-69.

Assimakopoulos, D. and Yan, J. (2006), ''Sources of knowledge acquisition for Chinese software engineers'', *R&D Management*, Vol. 36 No. 1, pp. 97-106.

Barney, J. (1997), *Gaining and Sustaining Competitive Advantage*, Addison-Wesley, Reading, MA.

Becker, B.E., Huselid, M.E. and Beatty, R.W. (2009), *The Differentiated Workforce: Transforming Talent into Strategic Impact*, Harvard Business School Press, Boston, MA.

Birkinshaw, J. and Sheehan, T. (2002), ''Managing the knowledge life cycle'', *MIT Sloan Management Review*, Fall, pp. 75-83.

Borgatti, S.P., Everett, M.G. and Freeman, M.C. (2002), *Ucinet for Windows: Software for Social Network Analysis*, Analytic Technologies, Harvard, MA.

Boston Consulting Group (2007), *The Future of HR: Key Challenges through 2015*, Boston Consulting Group, Düsseldorf.

Boudreau, J.W. and Ramstad, P.M. (2005), ''Talentship, talent segmentation, and sustainability: a new HR decision science paradigm for a new strategy definition'', *Human Resource Management*, Vol. 42, pp. 129-36.

Boudreau, J.W. and Ramstad, P.M. (2007), *Beyond HR: The New Science of Human Capital*, Harvard Business School Press, Boston, MA.

Brown, J.S. and Duguid, P. (2000), *The Social Life of Information*, Harvard Business School, Boston, MA.

Burt, R.S. (1992), *Structural Holes: The Social Structure of Competition*, Harvard Business Press, Cambridge, MA.

Caligiuri, P.M., Lazarova, M. and Tarique, I. (2005), ''Training, learning and development in multinational organizations'', in Scullion, H. and Linehan, M. (Eds), *International Human Resource Management: A Critical Text*, Palgrave Macmillan, Basingstoke.

Carlsson, S.A. (2003), ''Strategic knowledge managing within the context of networks'', in Holsapple, C.W. (Ed.), *Handbook on Knowledge Management*, Vol. 1, Springer, New York, NY, pp. 623-43.

Chesbrough, H.M. (2003), *Open Innovation*, Harvard Business School Press, Boston, MA.

Cohen, W. and Levinthal, D. (1990), ''Absorptive capacity: a new perspective on learning and innovation'', *Administration Science Quarterly*, Vol. 35, pp. 128-52.

Collings, D.G. and Mellahi, K. (2009), ''Strategic talent management: what is it and how does it matter?'', *Human Resource Management Review*, Vol. 19, pp. 304-13.

Cross, R. and Parker, A. (2004), *The Hidden Power of Social Networks. Understanding How Work Really Gets Done in Organizations*, Harvard Business School Publishing, Boston, MA.

Cross, R. and Prusak, L. (2002), ''The people that make organizations stop or go'', *Harvard Business Review*, Vol. 80, pp. 104-12.

Cross, R. and Thomas, R. (2008), ''How top talent uses networks and where rising stars get trapped'', *Organizational Dynamics*, Vol. 37, pp. 165-80.

Davenport, T. and Prusak, L. (2000), *Working Knowledge; How Organizations Manage What They Know*, Harvard Business School Press, Boston, MA.

Doak, S. and Assimakopoulos, D. (2007), ''How forensic scientists learn to investigate cases in practice'', *R&D Management*, Vol. 37 No. 2, pp. 113-22.

Dodgson, M. (1994), ''Technological collaboration and innovation'', in Dodgson, M. and Rothwell, R. (Eds), *The Handbook of Industrial Innovation*, Edward Elgar Publishing, Cheltenham.

Drucker, P. (1988), ''The coming of the new organization'', *Harvard Business Review on Knowledge Management*, Harvard Business School Press, Cambridge, MA, pp. 1-20.

Economist Intelligence Unit (2006), *The CEO's Role in Talent Management: How Top Executives from Ten Countries Are Nurturing the Leaders of Tomorrow*, The Economist Intelligence Unit, London.

Eisenhardt, K.M. (1989), ''Building theories from case study research'', *Academy of Management Review*, Vol. 14, pp. 532-50.

Frishammar, J. and Horte, S.A. (2005), ''Managing external information in manufacturing firms: the impact on innovation performance'', *Journal of Product Innovation Management*, Vol. 22, pp. 251-66.

Gladwell, M. (2000), *The Tipping Point: How Little Things Can Make Big Difference*, Little Brown, London.

Granovetter, M. (1973), ''The strength of weak ties'', *American Journal of Sociology*, Vol. 78 No. 6, pp. 1360-80.

Grant, R.M. (1996a), ''Prospering in dynamically-competitive environments: organizational capability as knowledge integration'', *Organization Science*, Vol. 7 No. 4, pp. 375-87.

Grant, R.M. (1996b), ''Toward a knowledge-based theory of the firm'', *Strategic Management Journal*, Vol. 17, pp. 109-22.

Guthridge, M., Komm, A.B. and Lawson, E. (2008), ''Making talent a strategic priority'', *The McKinsey Quarterly*, Vol. 1.

Jones, R. (2008), ''Social capital: bridging the link between talent management and knowledge management'', in Vaiman, V. and Vance, C.M. (Eds), *Smart Talent Management: Building Knowledge Assets for Competitive Advantage*, Edward Elgar, Cheltenham.

Katz, E. and Lazarsfeld, P.F. (1955), *Personal Influence: The Part Played by People in the Flow of Mass Communications*, The Free Press, Glencoe, IL.

Katz, R. and Tushman, M. (1981), ''An investigation into the managerial roles and career paths of gatekeepers and project supervisors in a major R&D facility'', *R&D Management*, Vol. 11, pp. 103-10.

Katz, R. and Tushman, M. (1983), ''A longitudinal study of the effects of boundary-spanning supervision on turnover and promotion in research and development'', *Academy of Management Journal*, Vol. 26, pp. 427-56.

Laursen, K. and Salter, A. (2006), ''Open innovation: the role of openness in explaining innovation performance among UK manufacturing firms'', *Strategic Management Journal*, Vol. 27, pp. 131-50.

Lazarsfeld, P.F., Berelson, B. and Gaudet, H. (1948), *The People's Choice*, Columbia University Press, New York, NY.

Lengnick-Hall, M. and Andrade, L.S. (2008), ''Talent staffing systems for effective knowledge management'', in Vaiman, V. and Vance, C.M. (Eds), *Smart Talent Management: Building Knowledge Assets for Competitive Advantage*, Edward Elgar, Cheltenham.

Leonard-Barton, D. and Sensiper, S. (1998), ''The role of tacit knowledge in group innovation'', *California Management Review*, Vol. 40 No. 3, pp. 112-31.

Lewis, R.E. and Heckman, R.J. (2006), ''Talent management: a critical review'', *Human Resource Management Review*, Vol. 16 No. 2, pp. 139-54.

Lowe, K.B., Milliman, J., De Cieri, H. and Dowling, P.J. (2002), ''International compensation practices: a ten-country comparative analysis'', *Human Resource Management*, Vol. 41 No. 1, pp. 45-66.

Macdonald, S. and Williams, C. (1993), ''Beyond the boundary: an information perspective on the role of the gatekeeper in the organization'', *Journal of Product Innovation Management*, Vol. 10, pp. 417-27.

Macdonald, S. and Williams, C. (1994), ''The survival of the gatekeeper'', *Research Policy*, Vol. 23, pp. 123-32.

McKinsey Consulting (1998), ''The war for talent'', *The McKinsey Quarterly*, August.

March, J.G. and Simon, H. (1958), *Organizations*, Wiley, New York, NY.

Miles, M.D. and Huberman, A. (1984), *Qualitative Data Analysis*, Sage, London.

Moreno, J.L. (1937), ''Sociometry in relation to other social sciences'', *Sociometry*, Vol. 1 Nos 1/2, pp. 206-19.

Myers, M.D. and Newman, M. (2007), ''The qualitative interview in IS research: examining the craft'', *Information and Organization*, Vol. 17, pp. 2-26.

Nonaka, I. (1994), ''A dynamic theory of organizational knowledge creation'', *Organization Science*, Vol. 5 No. 1, pp. 14-37.

Oates, B.J. (2006), *Researching Information Systems and Computing*, Sage, London.

O'Dell, C. and Jackson, C. (1998), *If Only We Knew What We Know: The Transfer of Internal Knowledge and Best Practice*, Free Press, New York, NY.

Parise, S. (2007), ''Knowledge management and human resource development: an applicatin in social network analysis methods'', *Advances in Developing Human Resources*, Vol. 9 No. 3, pp. 359-83.

Pawlowski, S.D. and Robey, D. (2004), ''Bridging user organizations: knowledge brokering and the work of information technology professionals'', *MIS Quarterly*, Vol. 28 No. 4, pp. 645-72.

Powell, W., Koput, K. and Smith-Doerr, L. (1996), ''Interorganizational collaboration and the *locus* of innovation: networks of learning in biotechnology'', *Administration Science Quarterly*, Vol. 41, pp. 116-45.

Rogers, E. (1962), *Diffusion of Innovations*, Free Press, New York, NY.

Rogers, E. (1995), *Diffusion of Innovations*, 4th ed., Free Press, New York, NY.

Teigland, R. and Wasko, M. (2003), ''Integrating knowledge through information trading: examining the relationship between boundary-spanning communication and individual performance'', *Decision Sciences*, Vol. 34 No. 2, pp. 261-87.

Tripsas, M. (1997), ''Surviving radical technological change through dynamic capability: evidence from the typesetter industry'', *Industrial and Corporate Change*, Vol. 6, pp. 341-77.

Tushman, M. (1977), ''Special boundary roles in the innovation process'', *Administrative Science Quarterly*, Vol. 22, December, pp. 587-605.

Tushman, M. and Katz, R. (1980), ''External communication and project performance: an investigation into the role of gatekeepers'', *Management Science*, Vol. 26 No. 11, pp. 1071-85.

Tushman, M. and Scanlan, T. (1981), ''Boundary-spanning individuals: their role in information transfer and their antecedents'', *Academy of Management Journal*, Vol. 24 No. 2, pp. 289-305.

Vaiman, V. and Vance, C.M. (2008), *Smart Talent Management: Building Knowledge Assets for Competitive Advantage*, Edward Elgar, Cheltenham.

Wenger, E., McDermott, R. and Snyder, W.W. (2002), *Cultivating Communities of Practice*, Harvard Business School Press, Boston, MA.

Whelan, E. and Donnellan, B. (2008), ''Knowledge diffusion in R&D groups; the impact of internet technologies'', paper presented at 16th European Conference on Information Systems, Galway, Ireland, June 8-11.

Whelan, E., Donnellan, B. and Golden, W. (2009), ''Analyzing R&D knowledge flows in the flat world'', *Journal of Information Technology Case and Application Research*, Vol. 11 No. 2, pp. 12-30.

Yin, R.K. (1994), *Case Study Research; Design and Methods*, Sage, London.

Zack, M. (2003), ''Rethinking the knowledge-based organization'', *Sloan Management Review*, Vol. 44 No. 4, pp. 67-71.

Further reading

Cappelli, P. (2008), ''Talent management for the twenty-first century'', *Harvard Business Review*, March, pp. 74-81.

DeVos, A. and Soens, N. (2008), ''The power of career counseling for enhanced talent and knowledge management'', in Vaiman, V. and Vance, C.M. (Eds), *Smart Talent Management: Building Knowledge Assets for Competitive Advantage*, Edward Elgar, Cheltenham.

Appendix

Introduction

Please answer all 4 questions. The questionnaire will only take 2-3 minutes to complete

*1. Your name?

☐

2. Please identify which work colleagues you discuss technical issues with at least once a week? [Please check all that apply]

☐ AA	☐ EE	☐ II
☐ BB	☐ FF	☐ JJ
☐ CC	☐ GG	☐ KK
☐ DD	☐ HH	☐ LL

3. How often do you use the following information sources in your everyday work?

	Several times a day	Once a day	Once every two days	Once a week	Once every two weeks	Once a month	More seldom
{Firm name} colleagues in other departments.	○	○	○	○	○	○	○
Contacts outside {Firm name} that you know personally (including face-to-face, phone, and e-mail contacts).	○	○	○	○	○	○	○
Academic publications.	○	○	○	○	○	○	○
Internet (other than accessing journal papers, i.e. websites, discussion forums, wikis, blogs)	○	○	○	○	○	○	○

4. Please identify sources outside of the R&D Group who are important in terms of providing you with information to do your work? [e.g. a specific website or contacts in another organisation]

1. _____

2. _____

Source: www.surveymonkey.com/s.aspx?sm=ydRzXOjqt2MDikYm_2bycaeQ_3d_3d (accessed 6 July 2009)

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